

TWO NEW SPECIES OF ASTERACEAE-FEEDING *BUCCULATRIX* (BUCCULATRICIDAE) FROM CALIFORNIA

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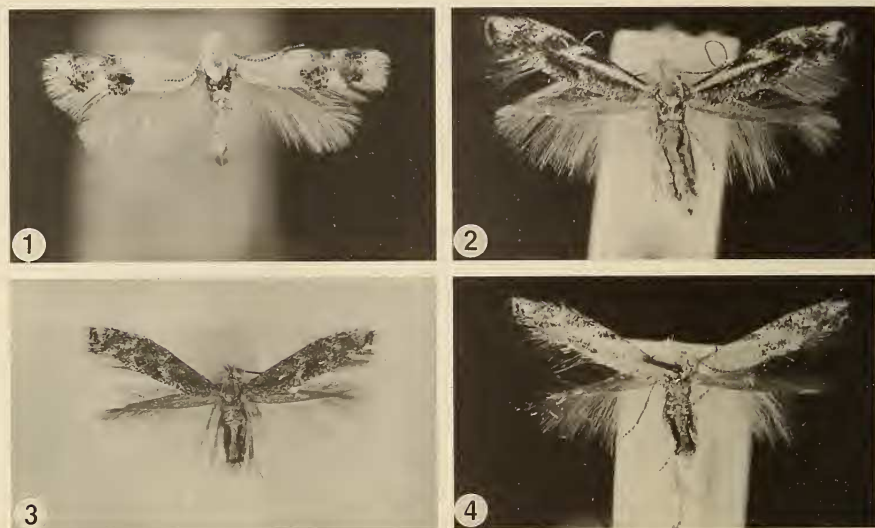
ABSTRACT. *Bucculatrix tetradymiae*, new species and *Bucculatrix dominatrix*, new species are described and illustrated. *Bucculatrix tetradymiae* feeds on *Tetradymia axillaris* (Strother) (Asteraceae) and *Bucculatrix dominatrix* feeds on *Baccharis pilularis* (de Candolle) (Asteraceae) and can be distinguished from sympatric, *Baccharis*-feeding *Bucculatrix variabilis* (Braun) and *Bucculatrix separabilis* (Braun) by its larger size, distinct forewing pattern, and genitalia.

Additional key words: *Tetradymia*, *Baccharis*, leaf miner, Lyonetiidae, microlepidoptera.

Zimmerman (1978) resurrected the family Bucculatricidae (Bucculatricidae) from Lyonetiidae, a move first proposed by Fracker (1915). The family is easily discerned, being characterized by an "elongate pointed face, tufted head, basal eye-cap of the antenna and, in the male, the notched first segment of the flagellum . . ." (Braun 1963). The larvae typically are leaf miners in the early instars, and then become external feeders, although a few species mature in the mine and some are gall-makers. For a complete description of the family refer to Braun (1963). The family is cosmopolitan with 222 species described from all land forms except New Zealand (Heppner 1991). More than 100 occur in North America, mostly in arid regions (Braun 1963). Larvae of many western species feed on Asteraceae, including the two species we describe here.

On 12 April 1993 in the western margin of the Mojave desert, California, we collected cocoons affixed to stems of the spiny shrub *Tetradymia axillaris*. Cut branches with attached cocoons were immersed in buckets of water and transported to our homes in central California and so maintained. Adult *Bucculatrix* emerged during late April and early May.

David Wagner, John De Benedictis and Jerry Powell collected a new *Bucculatrix* on Mt. San Bruno (San Mateo Co.), where it is sympatric with the *Baccharis*-feeding *Bucculatrix variabilis* and *Bucculatrix separabilis*; De Benedictis et al. (1990:p.20) briefly described the adult cocoon and larval biology of this species without naming it. This species has also been reared from Marin County and Sonoma County by Jerry



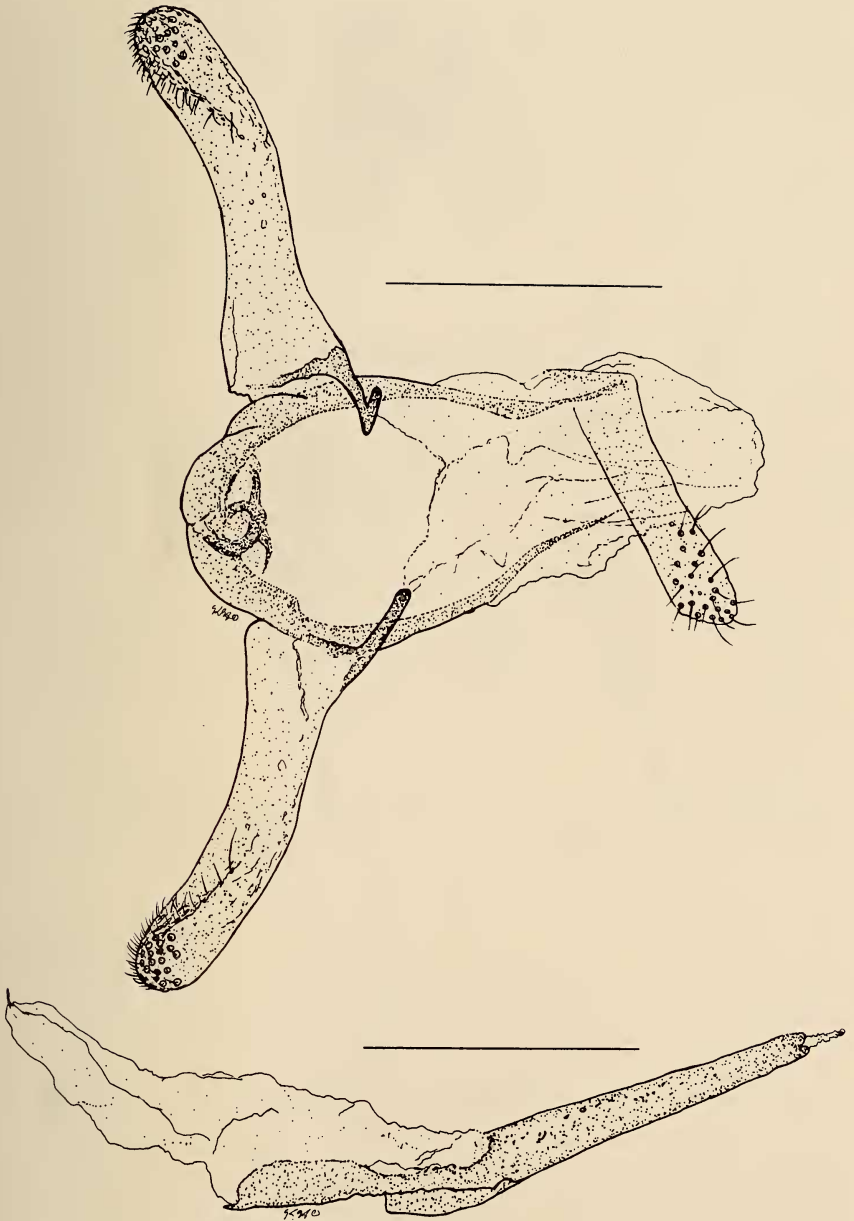
FIGS. 1-4. 1, *Bucculatrix tetradymiae* paratype female. California: San Bernardino Co.: Oro Grande Wash, 5 mi. W. of Hesperia, 12 April 1993 (Rubinoff and Osborne), reared from cocoon on *Tetradymia axillaris*, ex pupa 20 April 1993 (JAP 93D45). 2, *B. dominatrix* type female. California: Marin Co.: Ring Mountain, 19 April 1991 (J. A. Powell), reared from cocoon on *Baccharis pilularis*, ex pupa 1-2 May 1991 (JAP 91D16). 3, *Bucculatrix variabilis*. California: Monterey Co. Big Creek Reserve (UCNRS), 1-3 May 1992 (J. A. Powell) reared from cocoon on *Baccharis pilularis*, ex pupa 6 May 1992 (JAP 92E11). 4, *Bucculatrix separabilis*. California: Napa Co. 1 mile SE of Angwin, 20 May 1980 (J. A. Powell).

Powell and David Wagner, respectively. Both new species were sexed on the basis of frenulum morphology and external genitalia.

Bucculatrix tetradymiae Osborne and Rubinoff, new species (Figs. 1, 5-8)

Description. *Head.* White; antenna white with white basal eye-cap and dark brown annulations. *Thorax.* White. *Forewing.* Length: mean 3.4mm (range 3.2-3.8mm, n = 29). Dorsal surface lustrous white with distal half dominated by roughly equal-sized postmedial and submarginal blotches partially separated by white at anal angle and costa. Blotches, ochreous brown, tipped with dark brown. Postmedial blotch often bisected by diffuse longitudinal white or light brown. Occasionally blotches greatly reduced. Below fold, in proximal extreme of postmedial blotch, a very dark patch of completely and partially dark brown scales. Series of white, dark-tipped scales running dorsally from apex along margin to merge with distal edge of dark field. Usually a small patch of several dark brown tipped scales on costa at 1/3 from base to apex. Cilia brown above brown field on costa, white subapically, brown in streak at apex on apical end of marginal chain of brown scales, all white along margin. Ventral surface of forewing gray-brown. *Hindwing.* Gray dorsally, gray-brown ventrally with gray cilia. *Leg.* White with dark brown annulations on distal ends of tarsal segments. Metathoracic tibiae with long white cilia. *Abdomen.* Gray. Terminal scales elongate and dark gray dorsally in females.

Male genitalia (Figs. 5, 6 drawn from YFH prep no. 0911). Valva elongate, slightly curved medially with fine distal setation. Socii divergent, elongate, with long setae on dis-



FIGS. 5, 6. 5, *B. tetradymiae* paratype male genitalia. 6, aedeagus of same. Slide YFH 0911. California: San Bernardino Co., Oro Grande Wash, 5 mi. W. of Hesperia, 25 April 1993 (D. Rubinoff). Scale bars = 1 mm.

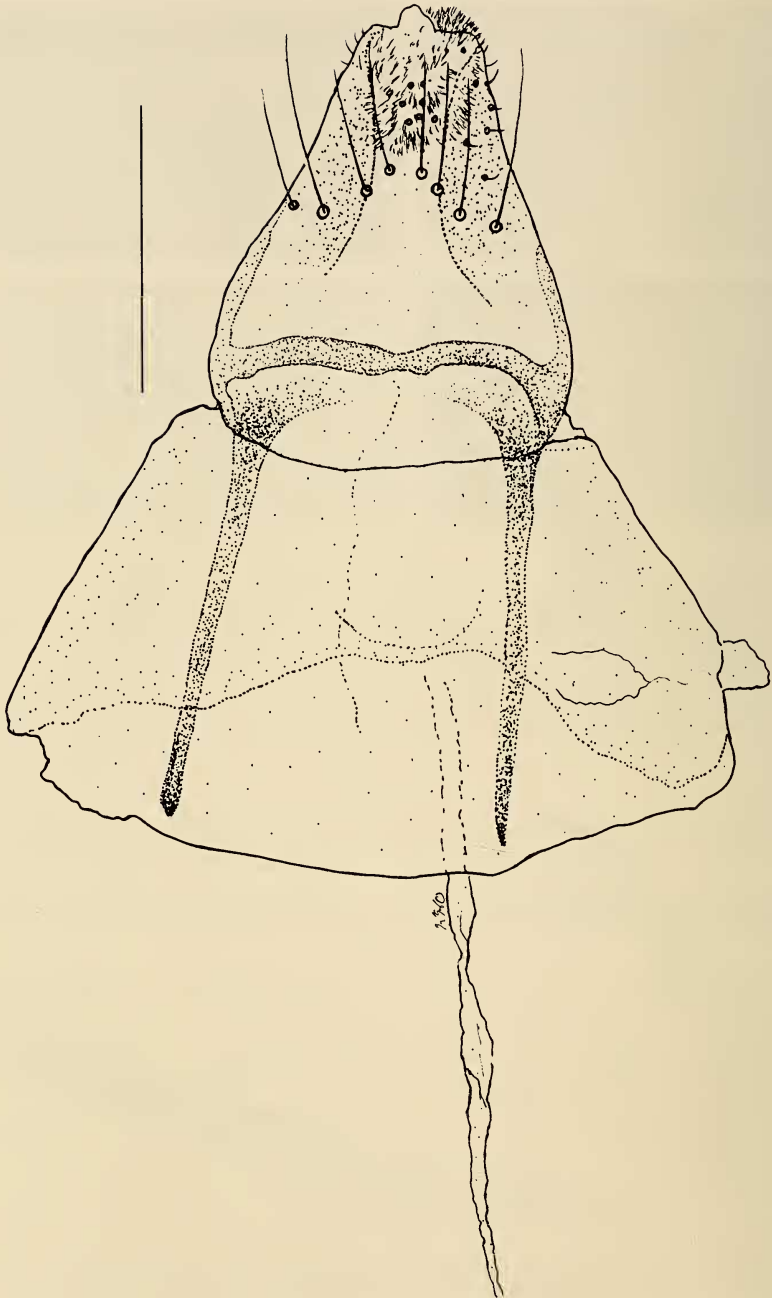


FIG. 7. *B. tetradymiae* paratype female genitalia. Slide YFH 0905. California: San Bernardino Co., Oro Grande Wash, 5 mi. W. of Hesperia, 25 April 1993 (D. Rubinoff). Scale bars = 1 mm.

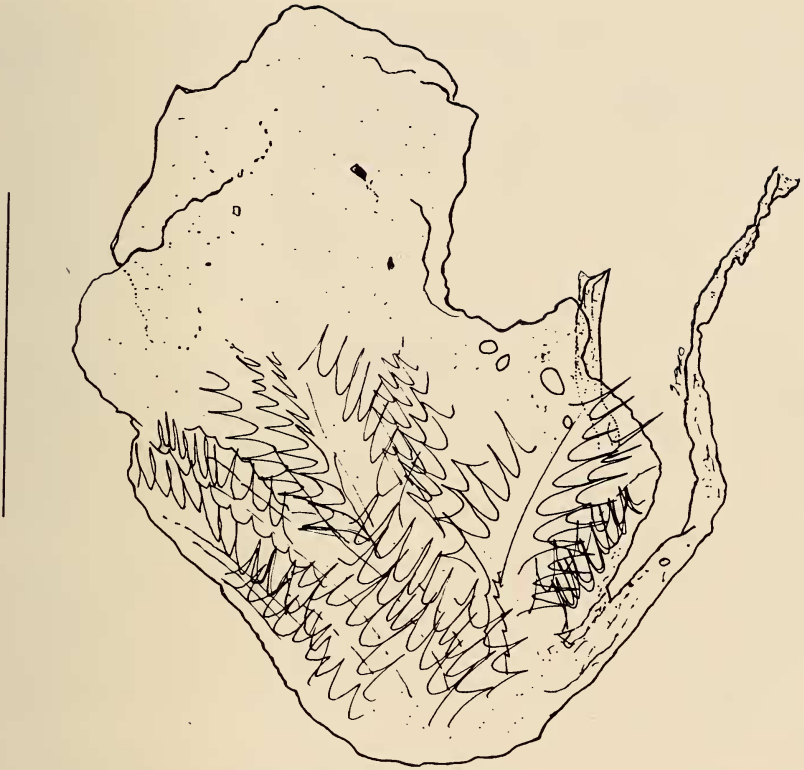


FIG. 8. *B. tetradymiae* paratype female genitalia, corpus bursae. Slide YFH 0906. California: San Bernardino Co., Oro Grande Wash, 5 mi. W. of Hesperia, 25 April 1993 (D. Rubinoff). Scale bars = 1 mm.

tal third. Gnathos absent. Vinculum narrow, well sclerotized. Aedeagus straight, gradually tapering to slender apex.

Female genitalia (Fig. 7 drawn from YFH prep no. 0905, Fig. 8 drawn from YFH prep no. 0906). Ductus bursae not sclerotized. Margins of ostium bursae weakly sclerotized. Ostium in anterior margin of abdominal segment eight. Ninth tergum with transverse row of long, stout setae at mid-segment. Posterior apophyses about length of abdominal segment eight, well sclerotized. Anterior apophyses absent. Ductus seminalis arising on corpus bursae near base of ductus bursae. Signum strong, nearly encircling posterior half of bursa, ribbed with long aciculae; converging toward base of ductus bursae.

Type specimens. *Holotype* ♂, California: San Bernardino Co.: Oro Grande Wash, 5 mi. W. of Hesperia, 12 April 1993 (Rubinoff and Osborne), reared from cocoon on *Tetradymia axillaris*, ex pupa 20 April 1993. *Paratypes* (n = 49): California: San Bernardino Co.: Oro Grande Wash, 5 mi. W. of Hesperia, 1 ♂, 1 ♀, 12 April 1993 (Rubinoff and Osborne), reared from cocoons on *Tetradymia axillaris*, ex pupa 20 April 1993; also 2 ♂, 6 ♀, 25 April 1993 (Rubinoff and Osborne) reared from cocoons on *Tetradymia axillaris*, ex pupa 1–3 May 1993 (JAP 93D48); also 17 ♂, 1 ♀, 27 April 1996 (Osborne); also 18 ♂, 3 ♀, 29 April 1996 (Osborne). The holotype and 26 paratypes are deposited at the Essig Museum of Entomology, University of California, Berkeley (UCB); 4 paratypes are deposited in the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C.

(USNM); 4 paratypes are deposited in the University of Connecticut collection at Storrs (UCONN); 3 paratypes are deposited in the Los Angeles County Museum (LACM); 3 paratypes are deposited in the Canadian National Collection of Insects (CNCI); 3 paratypes are deposited in the California Academy of Sciences (CAS); 4 paratypes remain in the collection of Kendall Osborne and 2 paratypes in the collection of Daniel Rubinoff.

Diagnosis and discussion. *Bucculatrix tetradymiae* is a small, white bucculatricid with brown blotches dominating the outer half of the forewing. *B. tetradymiae* keys out to *Bucculatrix packardella* (Chambers) (of the eastern United States) in Braun's (1963) key to the adults based on maculation. The oak-feeding *B. packardella* differs from *B. tetradymiae* by the brown speckles over the face, eye-caps and thorax, and by the dusting of brown-tipped scales over the forewing base. On the basis of genitalic characters and host specialization, *B. tetradymiae* falls within Braun's (1963) section II of *Bucculatrix* which contains the majority of North American, Asteraceae-feeding *Bucculatrix*; *B. packardella* is assigned to section IV.

Adult moths are found in close association with the host, *Tetradymia axillaris*, in the western Mojave Desert. The early stages probably mine the glabrose, fascicular leaves while the late stage larvae feed externally. The white cocoons were fixed lengthwise usually against axillary spines of the host, are mostly smooth with slight ridges discernible on the caudal terminus. This unusual smoothness (most *Bucculatrix* cocoons have conspicuous sculpturing) is not due to the cocoon-smoothing effects of parasitoids, as hypothesized by Braun (1963) since many of our cocoons were viable. Adults emerged between 20 April and 10 May 1994 in captivity from cocoons kept both indoors (room temperature) and outdoors in Berkeley, California.

We saw many adults on *Tetradymia* at Oro Grande Wash on 23 April 1994, but we found none when we returned on 13 May 1994. Adults are active from at least 1600 to 2000 hours. Females extrude the papillae anales while resting on the host plant and males rapidly crawl (about 1 cm per second) along the length of stems usually searching each axillary spine in sequence along a stem, then crawling or sometimes flying to a new stem. An observed mating lasted 45 minutes. All known specimens come from the type locality although the species should be expected over much of the Mojave desert and may extend over the range of its host.

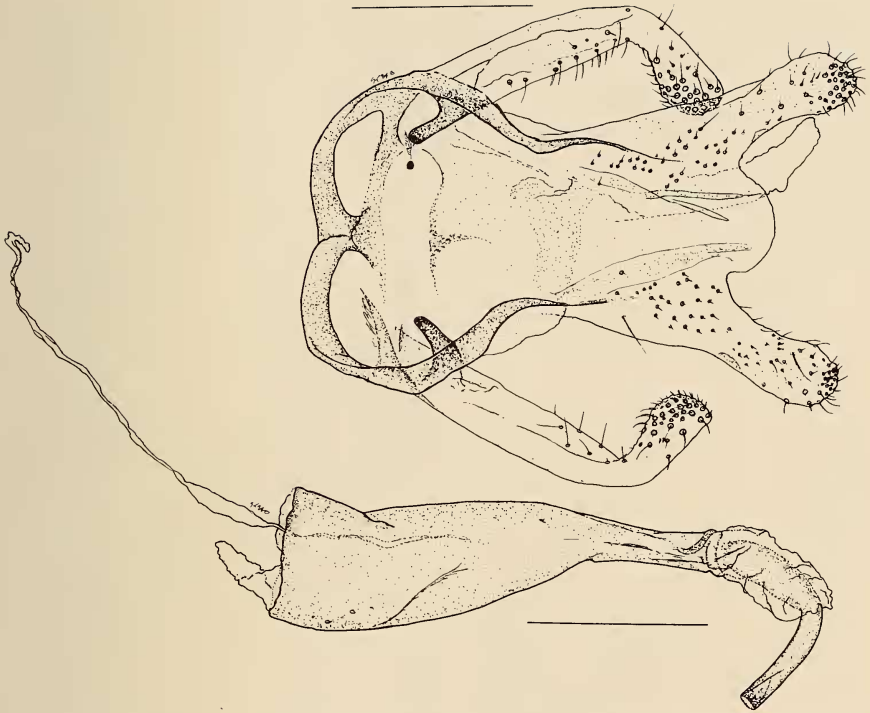
Bucculatrix dominatrix Rubinoff and Osborne, new species (Figs. 2, 9–12)

Description. *Head.* Grayish white, tuft brown and white hairs, eye-caps gray; antenna black and white banded. *Thorax.* grayish-white with scattered brown-tipped scales. *Forewing.* Length: mean: 5.5 mm (range: 4.0–6.1mm, n = 32), mottled brown, prominent longitudinal white streak extending above Cu from base along the discal cell, then abruptly jutting at acute angle towards costal margin. Just below Cu at acute angle in white streak, small, very dark patch of scales, just below (fold) vein. Distally, mottling becoming lighter, ending nearly white and surrounded by fuscous-tipped apical scales. Cilia gray. Ventral surface iridescent brown. *Hindwing.* Pale gray, ventral surface iridescent brown. *Leg.* Gray with distal end of tibia turning black. Tarsi banded with black and white. *Abdomen.* Silvery gray.

Male genitalia (Figs. 9, 10 drawn from YFH prep no. 0903). Valva elongate, pointing inwards at the setose distal ends. Soci divergent, very broad, more setose apically, and fused with tegumen. Saccus absent. Vinculum well-sclerotized band. Uncus poorly sclerotized with distal end obtuse. Aedeagus arising from tapered annellus. Distinguished from male genitalia of *B. variabilis* by much shorter, stout socii; very similar to male genitalia of *B. separabilis*.

Female genitalia (Figs. 11, 12 drawn from YFH prep no. 0907). Ostium in deep, well-sclerotized, cup-shaped chamber. Corpus bursae ovoid. Ductus seminalis originating on corpus bursae just dorsal to junction of ductus bursae and corpus bursae, no expansion of ductus seminalis apparent. Signum narrow, forming densely spined band of ribs at the posterior end of corpus bursae just anterior of where ductus seminalis and ductus bursae join corpus bursae.

Type specimens. *Holotype* ♀, California: Marin Co.: Ring Mountain, 19 April 1991



FIGS. 9, 10. 9, Paratype male genitalia of *B. dominatrix*. 10, aedeagus of same. Slide YFH 0903. California: Marin Co., Ring Mt., 19 April 1991 (J. A. Powell) reared from cocoon on *Baccharis pilularis*, ex pupa 1–5 May 1991 (JAP 91D16). Scale bars = 1 mm.

(J. A. Powell), reared from cocoon on *Baccharis pilularis*, ex pupa 1–2 May 1991 (JAP 91D16). *Paratypes* (n = 42): California: Marin Co.: Ring Mountain, 6 ♂, 5 ♀, 11 April 1994 (J. A. Powell), reared from cocoons on *Baccharis pilularis*, ex pupa 20–26 April 1994 (JAP 94D53); also, 6 ♂, 2 ♀ 19 April 1991 (J. A. Powell), reared from cocoons on *Baccharis pilularis*, ex pupa 1–5 May 1991 (JAP 91D16); San Mateo Co.: Mt. San Bruno County Park, 3 ♂, 2 ♀, 19 April 1988 (J. A. DeBenedictis) at b.l., also 3 ♂, 4 ♀, 21 April 1983 (J. A. DeBenedictis), reared from cocoons on *Baccharis pilularis*, ex pupa 11–17 May 1983 (JADeB 83111-E), also 1 ♀, 14 April 1983 (J. B. Whitfield), reared from cocoon on *Baccharis pilularis*, ex pupa 3 May 1983 (JAP 83D70); Alameda Co.: Strawberry Canyon, UCB campus, 1 ♂, b.l. trap, 1 July 1991 (J. A. Powell), also 1 ♂, 20 June 1990 (J. A. Powell); Sonoma Co.: 1 mi. SE Bodega Bay, 4 ♂, 4 ♀, 20 April 1983 (D. L. Wagner), reared from cocoons on *Baccharis pilularis*, ex pupa 3–24 May 1983 (JAP 83D110). The holotype and 20 paratypes are deposited in the Essig Museum of Entomology at the University of California, Berkeley (UCB); 3 paratypes are deposited in the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM); 11 paratypes are deposited in the University of Connecticut collection at Storrs (UCONN); 2 paratypes are deposited in the Canadian National Collection of Insects (CNCI); 2 paratypes are deposited in the Los Angeles County Museum (LACM); 2 paratypes are deposited in the California Academy of Sciences (CASC); 1 paratype remains in the collection of Kendall Osborne and 1 paratype in the collection of Daniel Rubinoff.

Diagnosis and discussion. *Bucculatrix dominatrix* is relatively large and distinguishable by a prominent white streak on the upper part of the discal cell, extending two

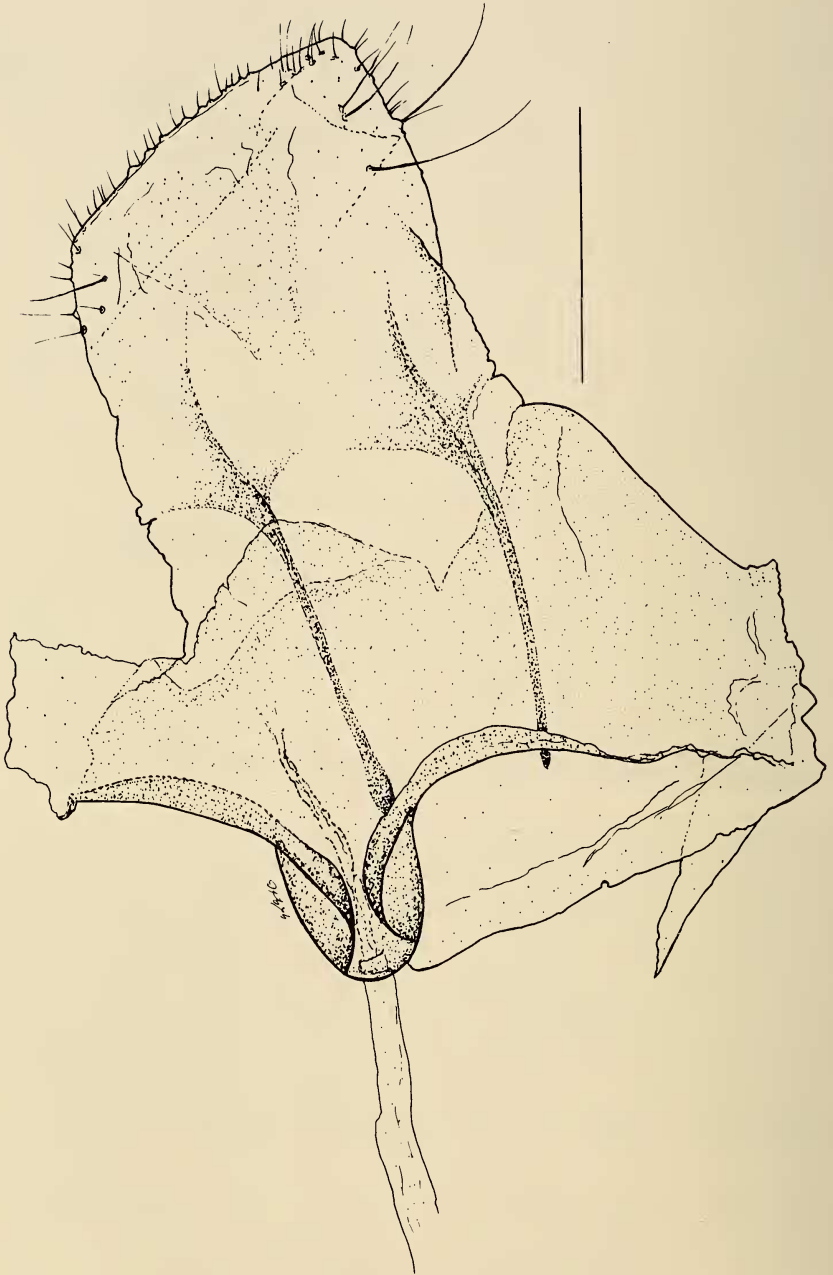


FIG. 11. Paratype female genitalia of *B. dominatrix*. Slide YFH 0907. California: Marin Co. Ring Mt., 19 April 1991 (J. A. Powell) reared from cocoon on *Baccharis pilularis*, ex pupa 1-5 May 1991 (JAP 91D16). Scale bars = 1 mm.

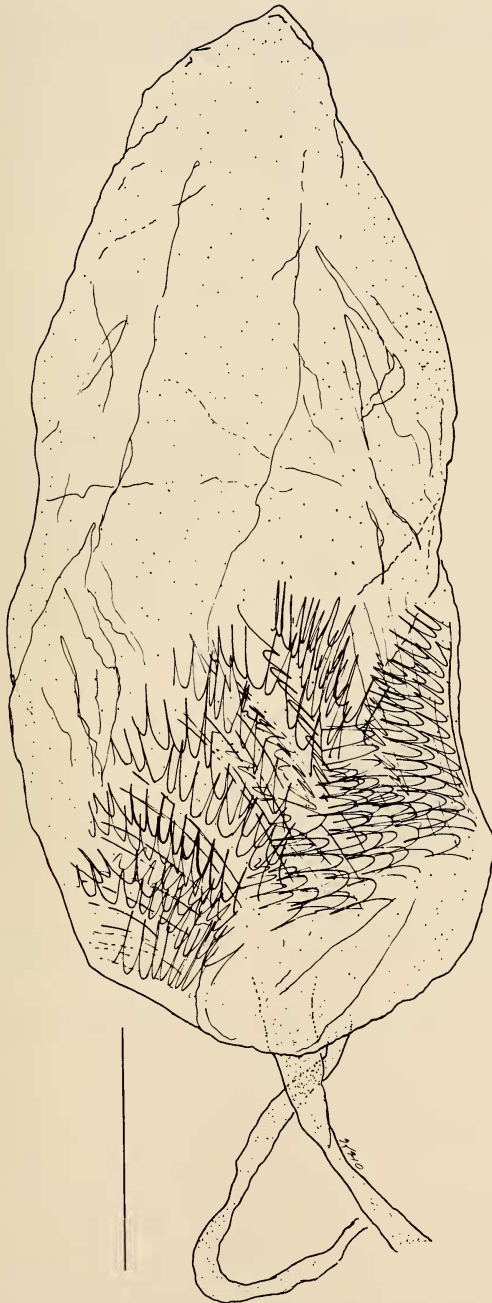


FIG. 12. Paratype female genitalia of *B. dominatrix*, bursa copulatrix. Slide YFH 0907. California: Marin Co. Ring Mt., 19 April 1991 (J. A. Powell) reared from cocoon on *Baccharis pilularis*, ex pupa 1-5 May 1991 (JAP 91D16). Scale bars = 1 mm.

thirds the length of the wing. *B. dominatrix* is probably a close relative of both *Bucculatrix variabilis* (Fig. 3) and *B. separabilis* (Fig. 4) and phenotypically resembles the former. The new species is 1.5 to 2 times larger than *B. variabilis*. The forewing pattern is diagnostic: *B. variabilis* has two transverse white bands whereas *B. dominatrix* has a single, longitudinal white streak. There is also a tuft of dark scales below the longitudinal band that is not present in *B. variabilis*. *B. dominatrix* is larger and much darker than *B. separabilis* but the genitalia are nearly identical, indicating a probable sister species relationship between the taxa. Phenotypic and genitalic similarities to the two aforementioned species merit its placement in Section II, subsection A, of Braun (1963). Average cocoon length is 8.1 mm (range: 6.5–11.5 mm, $n = 20$). They are strongly ribbed and pinkish when occupied (DeBenedictis et al. 1990) turning white after emergence.

Bucculatrix dominatrix may be widely distributed in coastal central California, where the hostplant is found. It feeds on *Baccharis pilularis* and can be found feeding on the same plants as both *Bucculatrix variabilis* and *B. separabilis*.

ACKNOWLEDGMENTS

We thank Jerry Powell for drawing our attention to the novelty of *B. tetradymiae* and the need for description of *B. dominatrix*, and his encouragement and tireless consultation during our efforts, Yu-Feng Hsu for preparing the genitalia slides and assistance with the manuscript, David Wagner for loaning specimens and, along with John De Benedictis, reviewing our manuscript in addition to collecting some of the first *B. dominatrix*. Additional thanks go to Don Davis for confirming the novelty of *B. tetradymiae*, Michelle Marvier for confirming our identification of the *Tetradymia* host, and to Larry Serpa of The Nature Conservancy, Tiburon, California for access to the Ring Mountain Preserve in Marin County. Comments from Lawrence Gall and two anonymous reviewers improved the quality of this paper. We are grateful to Sean O'Keefe for his skillful preparation of the photographs. Drawings were done by K. H. Osborne. Both authors contributed equally to the manuscript.

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Received for publication 13 November 1995; revised and accepted 13 July 1996.